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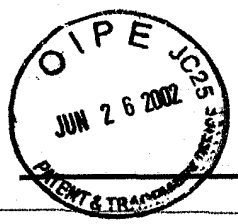
CLEAN VERSION OF PENDING CLAIMS



HIGH POWER ULTRASONIC TRANSDUCERS
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Serial No.: 09/577,805

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1. (Unchanged) A high power ultrasonic transducer comprising a housing having a predetermined geometry, means carried by the housing for providing power in excess of three kilowatts including transducer having one or more active elements made from a giant magnetostrictive material and means for producing an electromagnetic field which extends through at least a portion of the one or more active elements, the one or more active elements each changeable between a first shape when in the absence of the electromagnetic field and a second shape when in the presence of the electromagnetic field, means for providing an electrical signal to the means for producing an electromagnetic field and an acoustic element connected to the transducer for channeling ultrasonic energy to perform work.

2. (Unchanged) The ultrasonic transducer of Claim 1 wherein there is one cylindrically-shaped active element and wherein the means for producing an electromagnetic field is a coil made from conductive material concentrically disposed about the active element.

3. (Unchanged) The ultrasonic transducer of Claim 2 further comprising magnetic means for biasing the active element.

4. (Unchanged) The ultrasonic transducer of Claim 3 wherein the magnetic means includes tubular magnetic means concentrically disposed about the cylindrical element, the tubular magnetic means having first and second opposite end portions and a central portion between the first and second end portions, the first and second end portions having a radial thickness and the central portion having a radial thickness which is less than the radial thickness of the end portions for producing a substantially uniform bias over the length of the cylindrical element.

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5. (Unchanged) The ultrasonic transducer of Claim 4 wherein the first and second end portions having an inner diameter and the central portion has an inner diameter which is less than the inner diameter of the end portions.

6. (Unchanged) The ultrasonic transducer of Claim 5 wherein the first and second end portions are first and second annular members and wherein the central portion is a third annular member disposed between the first and second annular members.

7. (Unchanged) The ultrasonic transducer of Claim 2 wherein the cylindrical element has first and second opposite ends, first and second flux return elements carried by the housing adjacent the first and second ends of the cylindrical element for capturing magnetic flux through the cylindrical element.

8. (Unchanged) The ultrasonic transducer of Claim 7 wherein the first and second flux return elements are first and second disk-like elements made from a material having an electrical resistivity of at least about 0.01 ohm-cm and a magnetic saturation flux density of at least about 8,000 gauss.

10. (Unchanged) The ultrasonic transducer of Claim 1 further comprising magnetic means for biasing the active element.

11. (Unchanged) The ultrasonic transducer of Claim 1 wherein the acoustic element is mounted on the transducer and is made from a material having a quarter resonant wavelength, the acoustic element having a length equal to the quarter resonant wavelength of the material.

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12. (Unchanged) The ultrasonic transducer of Claim 1 wherein the acoustic element is made from an acoustic metal.

13. (Unchanged) The ultrasonic transducer of Claim 12 wherein the acoustic element is made from a magnesium alloy.

14. (Unchanged) The ultrasonic transducer of Claim 1 for use with a cooling fluid, the transducer including a passageway about the transducer adapted to receive the cooling fluid, the passageway formed from a material which is an electrical insulator.

16. (Unchanged) The ultrasonic transducer of Claim 14 wherein the material has a thermal conductivity greater than about one (1) W/m-K.

17. (Unchanged) The ultrasonic transducer of Claim 14 wherein the passageway is formed from hot pressed boron nitride.

18. (Unchanged) The ultrasonic transducer of Claim 14 wherein the passageway is a helical passageway within the transducer.

19. (Twice Amended) A high power ultrasonic transducer comprising a housing having a predetermined geometry, means carried by the housing for providing power in excess of three kilowatts, including a transducer having a cylindrical actuation element made from a giant magnetostrictive material and a coil made from electrically conductive wire concentrically disposed about the cylindrical element for producing an electromagnetic field that extends through at least a portion of the cylindrical element, the cylindrical element changeable between a first shape when in the absence of the magnetic field and a second shape when in the presence

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of the magnetic field, means for supplying an electrical signal to the coil and an acoustic element connected to the transducer for vibrating at an ultrasonic frequency in response to the transducer for performing work, the transducer capable of performing work on a continuous basis.

20. (Unchanged) The ultrasonic transducer of Claim 19 further comprising means for actively cooling the transducer which includes a fluid-carrying passageway which extends about the transducer, wherein the passageway is an electrical insulator.

22. (Unchanged) The ultrasonic transducer of Claim 20 wherein the fluid-carrying passageway is a helical passageway that extends through the cylindrical element.

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25. (Amended) The ultrasonic transducer of Claim 24 wherein the first and second flux return means are adjacent to the first and second end portions of the tubular magnetic means.

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29. (Twice Amended) A high power magnetostrictive ultrasonic actuator comprising an active element made from a giant magnetostrictive material having first and second ends, the giant magnetostrictive element changeable from a first shape to a second shape in the presence of a magnetic field, means for producing a magnetic field which extends through at least a portion of the active element and first and second flux return elements adjacent to the first and second ends of the giant magnetostrictive element for capturing magnetic flux produced by said means and directing the magnetic flux through the giant magnetostrictive element, wherein the high power magnetostrictive ultrasonic actuator contains a refrigeration system.

30. (Unchanged) An actuator as in Claim 29 wherein the means for producing a magnetic field includes a coil concentrically disposed about the giant magnetostrictive element.

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31. (Unchanged) An actuator as in Claim 29 further comprising a permanent magnet concentrically disposed about the giant magnetostrictive element for providing a Dc magnetic bias to the giant magnetostrictive element, the permanent magnet having first and second ends, the first and second flux return elements adjacent the first and second ends of the permanent magnet for capturing magnetic flux produced by the permanent magnet and directing said flux through the giant magnetostrictive element.